

Potential uses and applications of habitat restoration cost information

The California Habitat Restoration Project Database: Cost Data

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Opening

ABSTRACT

The California Habitat Restoration Project Database (CHRPD) is an ongoing effort to compile stream habitat restoration data and make this information widely available. The CHRPD will ultimately contain records for all restoration projects completed in California for which data can be obtained. An emphasis has been placed on the collection of cost data, making the database useful for detailed analyses of restoration project costs at local, regional and statewide levels.

INTRODUCTION

Planning the restoration and management of California's anadromous streams requires the ability to evaluate the successes and failures of past restoration efforts. Without a comprehensive, statewide stream habitat restoration project dataset, this kind of evaluation is difficult at best. There has until recently been no such dataset available; the CHRPD was initiated in 1999 to fill this need. The CHRPD is a cooperative effort involving the Pacific States Marine Fisheries Commission (PSMFC) and the California Department of Fish and Game (CDFG), with funding from the National Marine Fisheries Service (NMFS). In addition to serving as a repository for information about California habitat restoration projects, the CHRPD features a geographical component, with each project georeferenced. Widespread distribution of CHRPD data will assist restoration planners, policy makers, researchers and educators in analyzing and evaluating past trends, as well as making informed decisions regarding restoring streams and watersheds in the future.

The CHRPD aims to capture as many types of data about restoration projects in as consistent a manner as possible. Great variability exists in the availability of data for different projects, as well as in the quality and consistency of the data that is available. The standard project data collected, though, can be stated simply as who, what, when, where, why and how. Within these general categories are many

detailed observations about the projects, maintained in a database structure that has the flexibility to accommodate varied levels of data quality and consistency.

A key component of restoration planning is the cost of the work to be done, so a special focus of the CHRPD is capturing cost data in as much detail as possible. Again, flexibility in the database structure is crucial, because the cost data availability and quality are especially variable. Also, it is important to be confident about the data that are present in the database, to ensure that calculations and analyses using cost data are as accurate and precise as possible.

DATABASE METHODS

Data Sources

All data currently in the CHRPD are from the CDFG's Fisheries Restoration Grants Program; these data include all stream habitat restoration projects completed since 1981 and funded through the CDFG. Expansion of the database to include restoration projects completed by other agencies and organizations in California is now underway.

Database Structure and Data Categories

The CHRPD is composed of a relational database, maintained in Access 2000, with each project georeferenced. The database structure is based on the StreamNet Data Exchange Format (www.streamnet.org), with new tables added to accommodate specific needs for data collection in California. The StreamNet database format includes the following data categories: project beginning and ending dates, purpose, project location, goals and treatment details, monitoring, project participants and both their work and financial input, land ownership, and species affected by the project. New data categories added for California data include: watershed planning recommendations (for watershed survey projects only), project funding proposals and appropriations, final report data (including whether the project goals were met), detailed budget information, and rates charged for specific budget items. The specific fields in each of these categories are described in Table 1 and a schematic of the database structure (not the actual table relationships) is shown in Figure 1.

Table 1. Data types in the CHRPD. Based on StreamNet database structure (www.streamnet.org) with California-specific changes

General Project Information	<ul style="list-style-type: none"> • Project name • Data compilation date • Source person for data • Source agency for data • Frequency data are to be updated • Primary subbasin (4th field hydrologic unit) • Status of project (planned, ongoing, completed) • Bibliographic information supporting data • Whether entire project is anonymous • First year of work on project • Last year of work on project • Purpose of project • Limiting factors addressed by the project
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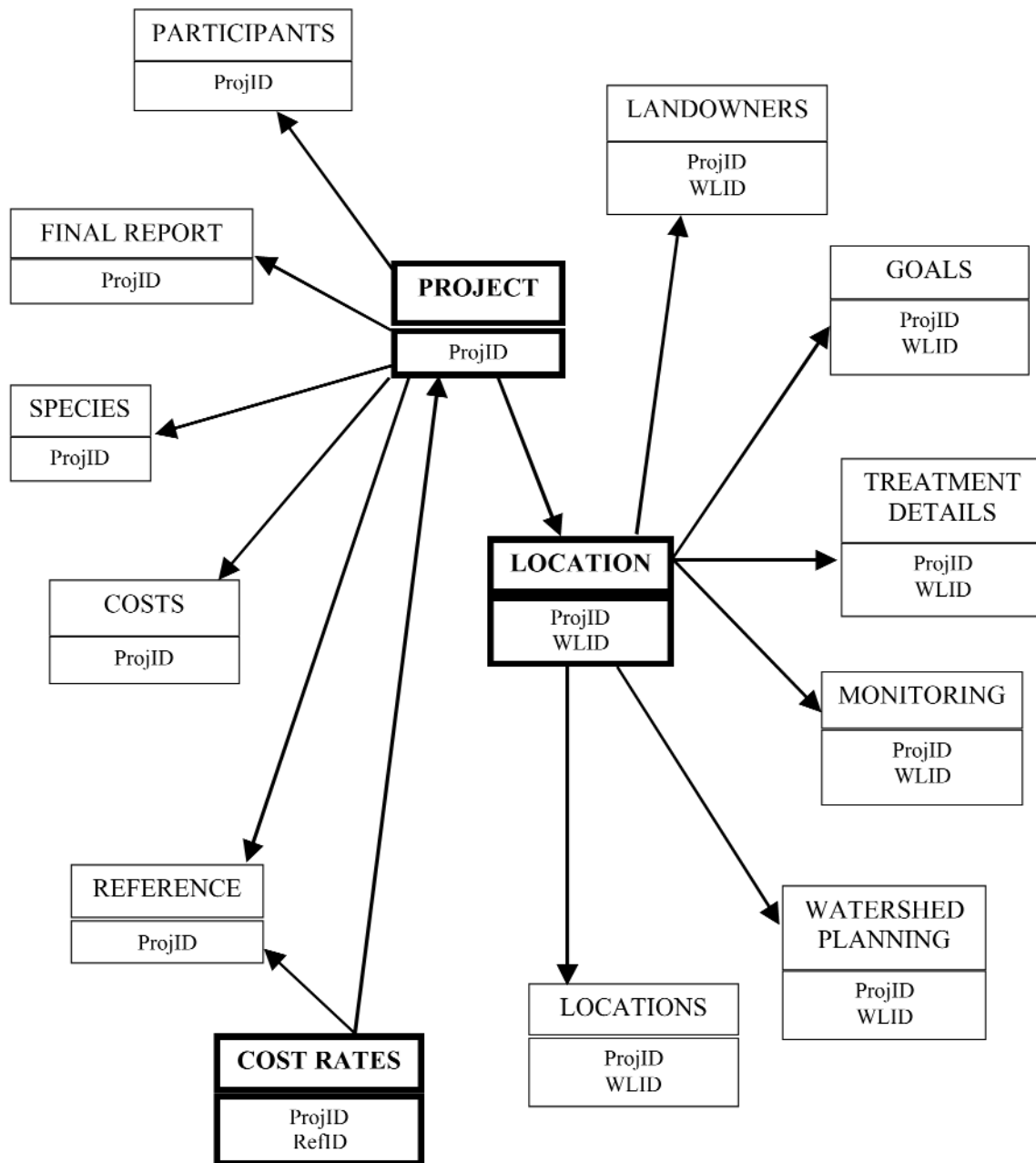
Table 1. Data types in the CHRPD. Based on StreamNet database structure (www.streamnet.org) with California-specific changes (cont'd.)

General Project Information (cont'd.)	<ul style="list-style-type: none"> • Time frame for which results are expected • Analysis of the project (things that facilitated, complicated or would help the project) • Whether a final report is on file • Whether the project goals were modified, and if so, how • Comments (general)
Target Species Information	<ul style="list-style-type: none"> • Species name • Whether species is a target species or a secondarily affected species (negative or positive) • Species run • Species subrun • Species rearing type (natural or hatchery)
Participant Information	<ul style="list-style-type: none"> • Participant name (may be many) • Whether participant wants to remain anonymous • Year(s) of participation for each participant • Project number used by the participant (for CDFG-funded projects, this is the contract number) • Name of program that participant operated under (for CDFG-funded projects, this is the name of the funding source) • Role of participant (funder, on-ground implementor, or both) • Whether participant is the primary coordinator for the project • Dollar amount of cash, in-kind support, labor, equipment, materials and total amount spent by each participant • Dollar amount of money requested by participant in project proposal and amount appropriated by funding agency (for funder participants only) • Contact person for each participant (name, title, address, phone, fax, email, comments) • Comments
Location-Specific Information	<ul style="list-style-type: none"> • Site names • General work type category at each site (instream, riparian, upland, wetland, road work) • Site type • Spatial type (code for how project location is georeferenced: stream point or reach, nonstream point, nonstream arc, or polygon) • Land cover • Land use

Table 1. Data types in the CHRPD. Based on StreamNet database structure (www.streamnet.org) with California-specific changes (cont'd.)

Location-Specific Information (cont'd.)	<ul style="list-style-type: none"> • Goals for each work type, location • Details and quantity of work done at each location (also which work and how much was done by each participant) • Land ownership at each project location, including owner name, percent of project area owned, owner type (government, private, tribe, etc.), and contact for each owner • Recommendations for work to be done at specific sites based on watershed planning survey (for watershed survey projects only) • Comments
Monitoring Data	<ul style="list-style-type: none"> • Monitoring methods (if any) • Monitoring objectives • Whether control data were collected • Whether monitoring data are available • Types of data collected • Comments
Cost Information	<ul style="list-style-type: none"> • Costs of each item in the budget, including quantity and units • Items divided into personnel, materials, operating, and overhead categories • Both projected and actual budgets can be captured • Rates charged for various items can be recorded (in a table that also has the capacity to hold rate data from sources other than project documentation, such as restoration planning manuals or research papers) and then used to calculate average rates for these items

Figure 1. CHRPD general structure



This is a schematic of the database structure and does not represent the actual relationships between tables.
 General data categories are in capital letters.
 The names of the fields linking the categories are listed below the category name:
 ProjID is a unique identifier for each project
 WLID is a unique identifier for each work type and location within a project
 RefID is a unique identifier for each reference from which project data have been collected.

Georeferencing

Projects are located geographically by marking the measures of their position along a stream; points have one measure and lines have two, one at the beginning and one at the end of their reach. Their locations can then be stored in a database table as coordinates along streams; the only data needed are the unique ID of the streams and the projects' distances from the mouths of their streams. These database tables can easily be converted to shapefiles for geographical analysis. In the case of projects that did not take place on streams (for example, road or upslope work) or projects whose streams do not yet exist in the streams coverage, their locations are mapped by heads-up digitizing directly into shapefiles. Polygons are also heads-up digitized and stored in shapefiles.

The process of georeferencing instream projects requires a GIS layer containing statewide routed hydrography. Routed hydrography makes it possible to treat an entire stream as a single entity, rather than a series of segments broken up by the stream's tributaries. As a result, it is possible to locate projects at specific locations along the stream, with reference to the entire stream length. Currently, the CHRPD is using 1:100,000 routed hydrography, but will take advantage of 1:24,000 hydrography once a complete layer is available for California.

Reference Files

In the case of the CDFG Fisheries Restoration Grants Program data, documents for each project have been stored in folders. In order to keep track of all of this supporting documentation, each folder is assigned a unique reference ID. The reference ID thus refers to a collection of documents. Because there are a large number of documents for each project, it would be impractical to assign unique numbers to each. As project files have been examined, they have been left in their original order in

their boxes. The boxes are loosely organized by date of contract initiation, and in some cases there is no discernible order. Each file has been assigned a reference ID, though, so it is now possible to use the database to rapidly locate a particular paper file.

DATA QUALITY

General

The amount and quality of data that have been extracted from the database and paper files maintained by the CDFG Fisheries Restoration Grants Program vary widely. Both quantity and quality are dependent on contractor reporting, which is in turn dependent on CDFG requirements and enforcement of these requirements. The enforcement of minimum reporting requirements has improved dramatically over the years, so there are more data available for more recently completed projects. In addition, data quality is dependent on CDFG record keeping, the amount of paper documentation saved and the care with which data are entered into the database.

While all data categories suffer from occasional missing data, location data are profoundly affected by the manner in which the project was reported. For example, when a contract was granted to do work in several different locations, these locations are sometimes divided into several different projects (each with a separate ProjID). In other cases, though, these same locations are left as a single project (one ProjID and a WLID for each discrete work type and location). There has been little consistency in how projects are divided by CDFG and contractors for purposes of budgeting; one contract may have five budgets for five locations or only one budget for five locations. As a result, decisions about how to break up projects in the CHRPD have been made based on the need to capture as much cost data as possible. This means that if five budgets are

reported within a single contract, the contract is entered into the database as five projects, but if five locations are given a single budget, the contract is entered as one project with five WLIDs. One important result of this system is that to obtain counts of projects completed, the total number of projects (ProjIDs) is less reliable than the total number of locations within each project (WLID and ProjID).

The project location data are also affected by the presence and quality of maps accompanying the contractors' reports. Some representation of the project location must be present in the file in order for the project to be digitized. How the project is digitized is entirely dependent on the way the contractor chose to represent it on a map. For example, a project involving the placement of five instream structures might be represented as five points along the stream by one contractor. It might be represented by a different contractor as a single line along the segment of stream containing the structures. Project locations are digitized with the greatest detail possible given the contractors' maps.

Cost Data

Reporting of cost data varies widely between projects, depending especially on the contractor, but also on when the project was done and whether all project documents have been saved in the files. In order to calculate average amounts spent on specific items for specific types of projects, it is very important to capture as many detailed cost data as possible. Unfortunately, many projects only have a projected budget on file, so the actual amounts spent are unknown. Of the projects that have any budget at all, 60% have projected budgets and only 45% have actual budgets. Furthermore, most budgets, projected or actual, are not itemized in great detail. Most often, when a budget has been itemized at all, it is divided only into personnel, materials, operating and overhead cate-

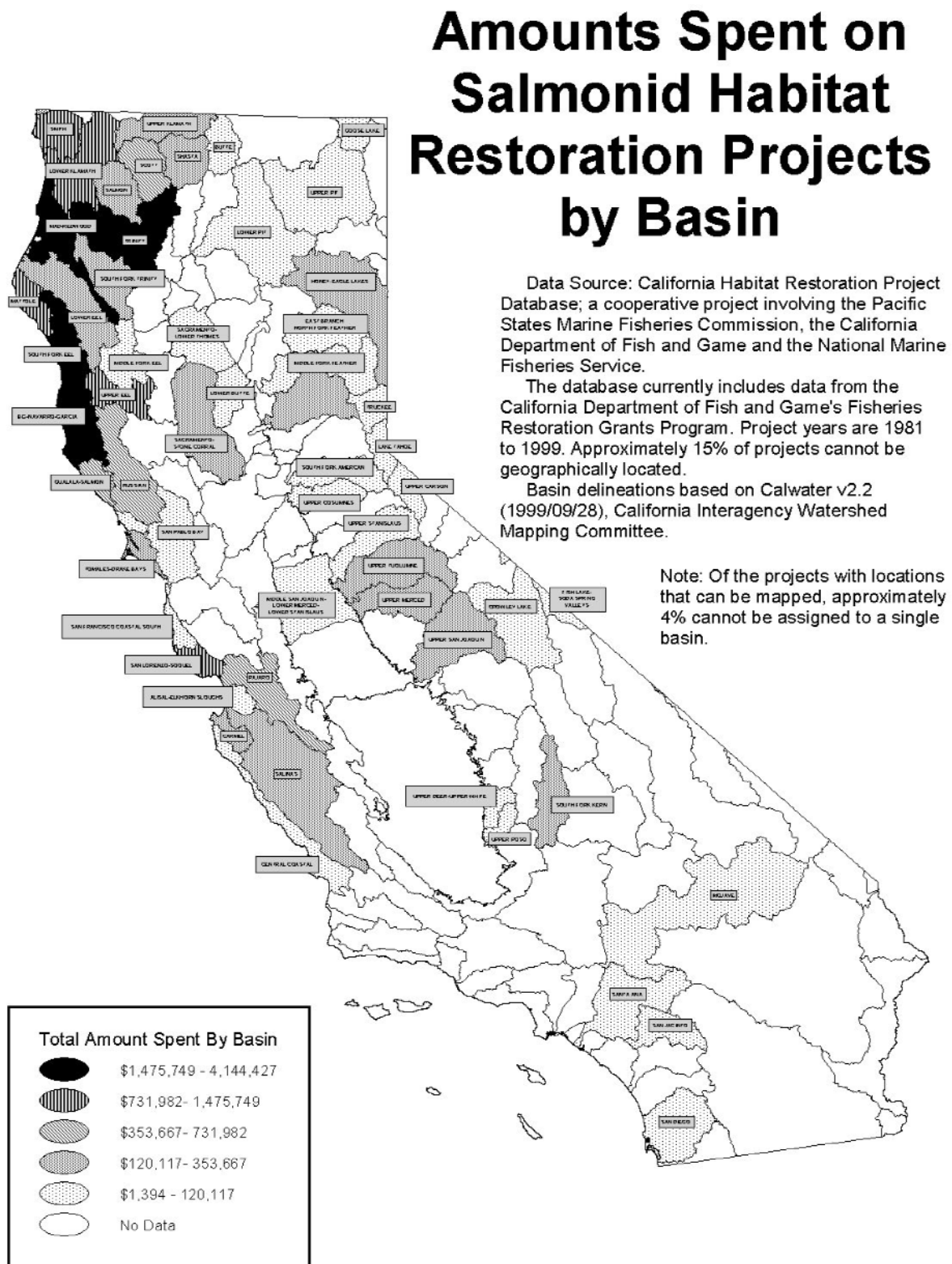
gories, without listing specific items within each category. Ideally, budgets list each separate item with the quantity and units purchased and the cost.

Many projects involve multiple funding sources, but the CDFG records often only include the money used from the CDFG grant. In most cases, it is impossible to determine whether the project used funding from other sources in addition to CDFG. In some cases, though, the final report states that additional funding was used but does not provide the amount. Only in rare cases are the additional funding amounts described. If in-kind contributions and funds from other sources are not reported, the total amount spent listed in the database will be a gross underestimate of the true total spent.

COST DATA PRODUCTS

The cost data being captured in the CHRPD lend themselves to analyses at many different levels, from local summaries of amounts spent on work done along a single stream, to statewide surveys of amounts spent within entire watersheds or basins. It is possible to report total amounts spent as well as amounts spent on individual budget items; average amounts are also easily obtained. Following are some examples of cost data summaries, including a map showing the total amounts of money spent on restoration projects in California basins (Figure 2), a summary of the total amounts spent on restoration projects in California each year since 1981 (Table 2), and the average rates charged for budget items in Siskiyou County, sorted by type of work done (Table 3).

Figure 2. Amounts spent on restoration projects by watershed



**Table 2. Total amounts spent on restoration projects by year
(corrected for inflation to 1999 dollars)**

Year	Total # of projects	Total costs (\$)	Average cost per project (\$)
1982	5	263,129.85	52,625.97
1983	8	946,812.99	118,351.62
1984	21	1,003,358.61	47,778.98
1985	33	1,123,425.68	34,043.21
1986	40	1,171,509.73	29,287.74
1987	34	1,983,044.16	58,324.82
1988	32	2,011,743.69	62,866.99
1989	91	5,055,842.51	55,558.71
1990	122	8,198,886.22	67,203.98
1991	78	2,308,533.18	29,596.58
1992	61	1,506,625.51	24,698.78
1993	42	3,371,489.08	80,273.55
1994	40	1,207,227.43	30,180.68
1995	35	966,650.78	27,618.59
1996	25	449,949.92	17,997.99
1997	18	364,486.78	20,249.27
1998	12	333,898.58	27,824.88
1999	2	20,309.80	10,154.90

**Table 3. Average rates charged for budget items in Siskiyou County
(corrected for inflation to 1999 dollars)**

Work Type	Budget Type	Item Name	Avg. Rate (\$/unit)	Units	# Obsv.	Min. (\$)	Max. (\$)	St. Dev
Education, training, workshops	Personnel	Crew leader	10.71	hour	1	10.71	10.71	
Education, training, workshops	Personnel manager	Project	13.52	hour	1	13.52	13.52	
Instream work	Materials	Fencing	4,261.44	mile	1	4,261.44	4,261.44	
Instream work	Materials	Fisheries biologist	20.27	hour	4	20.27	20.27	
Instream work	Materials	Gravel	11.27	cubic yard	1	11.27	11.27	
Instream work	Materials	Gravel	3.83	ton	1	3.83	3.83	
Instream work	Materials	Lumber	0.58	foot	1	0.58	0.58	
Instream work	Materials	Metal gate	186.55	gate	1	186.55	186.55	
Instream work	Materials	Rip-rap	48.41	ton	2	18.53	78.29	42.26
Instream work	Materials	Rock	21.45	ton	1	21.45	21.45	
Instream work	Operating	Administrator	23.37	hour	2	12.35	34.40	15.59
Instream work	Operating	Backhoe rental	40.53	hour	4	40.53	40.53	
Instream work	Operating	Dump truck rental	67.62	hour	4	67.62	67.62	
Instream work	Operating	Equipment lease/rental	30.10	hour	1	30.10	30.10	
Instream work	Operating	Excavator rental	130.00	hour	4	120.40	139.59	11.08
Instream work	Operating	Explosives technician	788.90	tree	1	788.90	788.90	
Instream work	Operating	Generator rental	115.80	week	1	115.80	115.80	
Instream work	Operating	Loader rental	110.76	hour	5	57.90	123.97	29.55

**Table 3. Average rates charged for budget items in Siskiyou County
(corrected for inflation to 1999 dollars) (cont'd.)**

Work Type	Budget Type	Item Name	Avg. Rate (\$/unit)	Units	# Obsv.	Min. (\$)	Max. (\$)	St. Dev
Instream work	Operating	Site preparation	31.05	foot	6	7.18	74.84	33.97
Instream work	Operating	Site preparation	31.05	hour	3	7.18	74.84	37.98
Instream work	Operating	Telephone	1.33	call	1	1.33	1.33	
Instream work	Operating	Travel	0.34	mile	1	0.34	0.34	
Instream work	Personnel	Biologist	16.16	hour	1	16.16	16.16	
Instream work	Personnel	Chainsaw rental	162.12	week	1	162.12	162.12	
Instream work	Personnel	Clerical	14.35	hour	1	14.35	14.35	
Instream work	Personnel	Construction supervisor	8.11	hour	1	8.11	8.11	
Instream work	Personnel	Crew leader	10.46	hour	2	8.79	12.12	2.35
Instream work	Personnel	Habitat biologist	46.37	hour	4	42.14	50.61	4.89
Instream work	Personnel	Hydrology technician	68.93	hour	4	60.20	77.66	10.08
Instream work	Personnel	Laborer	12.22	hour	20	6.95	18.34	3.53
Instream work	Personnel	Project manager	17.13	hour	6	10.42	20.27	4.87
Instream work	Personnel	Project supervisor	17.59	hour	1	17.59	17.59	
Riparian work	Materials	Fencing	15.99	foot	3	2.64	39.94	20.79
Riparian work	Materials	Fencing	15.99	post	3	2.64	39.94	20.79
Riparian work	Materials	Fencing	15.99	roll	3	2.64	39.94	20.79
Riparian work	Materials	Land dedicated	471.60	acre	2	419.20	524.00	74.10

**Table 3. Average rates charged for budget items in Siskiyou County
(corrected for inflation to 1999 dollars) (cont'd..)**

Work Type	Budget Type	Item Name	Avg. Rate (\$/unit)	Units	# Obsv.	Min. (\$)	Max. (\$)	St. Dev
Riparian work	Materials	Pipe	2.93	foot	1	2.93	2.93	
Riparian work	Materials	Pump and hose	1.52	foot	1	1.52	1.52	
Riparian work	Materials	Rock	8.97	cubic yard	4	6.37	11.58	3.01
Riparian work	Materials	Water	39.30	acre foot	1	39.30	39.30	
Riparian work	Operating	Admin-istrator	12.12	hour	2	12.12	12.12	
Riparian work	Operating	Backhoe rental	115.80	hour	1	115.80	115.80	
Riparian work	Operating	Power auger rental	40.40	hour	2	40.40	40.40	
Riparian work	Operating	Truck rental	25.25	day	1	25.25	25.25	
Riparian work	Personnel	Biologist II	18.22	hour	8	18.22	18.22	
Riparian work	Personnel	Civil engineer technician	26.06	hour	1	26.06	26.06	
Riparian work	Personnel	Fiscal officer	22.51	hour	7	22.51	22.51	
Riparian work	Personnel	Laborer	16.05	hour	4	7.10	39.67	15.80
Riparian work	Personnel	Project coordinator	15.00	hour	1	15.00	15.00	

As this map and these tables demonstrate, the CHRPD is suited to a variety of different cost summaries and analyses. The geographical component of the database enables the production of maps that graphically represent the distribution of various aspects of the restoration projects (especially costs); summaries such as that shown in Figure 2 are particularly useful for providing a quick overview of past patterns of spending on restoration projects in California. The map demonstrates that most spending has been

concentrated in the northwestern portion of the state, which corresponds to the areas of highest anadromous fish populations.

Another general overview of spending patterns is presented in Table 2, which summarizes spending on all California restoration projects by year. While the numbers of projects and total amounts spent on all projects varies widely from year to year (the extremely low numbers of projects in 1998 and 1999 reflects the fact that not all of the most recently completed projects have

been entered into the database), the average cost per project has remained relatively constant.

More detailed summaries of the project data are also possible, as demonstrated in Table 3. Average amounts spent on various items listed in project budgets (projected and actual) are reported in this table for all of the projects completed in Siskiyou County between 1981 and 1999. The projects are sorted by work type, which allows comparisons of costs between different types of projects as well as between different geographical locations (projects could also be sorted by basin or watershed, for example). These data are particularly valuable for estimating the costs of new restoration projects; costs specific to work type and location are easily obtained and can serve as a basis for calculating expenditures on similar work in the future.

These are only a few examples of the many ways to represent CHRPD cost data. These data are very important for both evaluating past anadromous habitat restoration

projects and planning future work. Cost data will continue to be a priority in the CHRPD. As mentioned in Table 1, new sources of cost data will be sought and these will supplement the data obtained from restoration project documentation. Other sources will include restoration planning manuals, surveys and studies, and estimates made by various restoration planners summarizing their work.

The CHRPD is currently seeking new sources of habitat restoration project data, expanding the focus of the database beyond projects funded by the CDFG. The goal of the CHRPD is to include all restoration projects completed in the state of California between 1981 and the present, and to update the data yearly so that the database remains current. A comprehensive database of California habitat restoration projects is a powerful tool for studying restoration efforts in the state and applying knowledge of past work to a better understanding of what needs to be accomplished in the future and how best to effect this change.

